A MONSTROSITY IN TRILLIUM GRANDIFLORUM.

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The genus Trillium seems to be especially subject to deviations from the normal structure. This tendency is mentioned both in Gray's Manual and in Britton and Brown's Flora, while in the botanical periodicals there are references to structural abnormalities in practically all species of the genus. Mr. Walter Deane, of the New England Botanical Club, who has collected extensively throughout the eastern United States, has reported a number of monstrosities. In the common Painted Trillium (*T. undulatum* Willd.) he has described several anomalous forms (*Rhodora*, Vol. 10, '08, p. 21–24 and p. 214–216; Vol. 12, '10, p. 163–166) from Massachusetts, Maine, New Hampshire and New York, some with flowers on the plan of four rather than three, others with as many as four superposed whorls of leaves, and others showing even greater irregularities of structure. The same author has described (*Rhodora*, Vol. 13, '11, p. 189–191) a specimen of *T. ovatum* Pursh. from Washington in which sexual organs were lacking and petals were multiplied to twenty-four; and also an abnormal *T. erectum* (*Rhodora*, Vol. 12, '10, p. 165) from the White Mountains which showed a numerical plan of four in all parts of the flower except the sepals which curiously enough were five in number. *T. sessile* L. has also furnished instances of departure from the normal type. One specimen was described by L. S. Hopkins (*Plant World*, '02, p. 182–183) with three whorls of leaves and an abnormal flower, and another was recorded by Prof. F. M. Andrews (*Plant World*, '06, p. 101) from near Bloomington, Ill., with fourteen petals and no sexual organs. Moroever in *T. recurvatum* Beck. Prof. Andrews (loc. cit.) described a most remarkable specimen with twenty-three petals.

In the species with which the present paper is concerned, *T. grandiflorum* (Michx.) Salisb. at least three instances of teratological formation have been recorded. A case of multiplication of the petals was described by Mrs. W. A. Kellerman in a plant collected in Jefferson County, Ohio (*Asa Gray Bul.* Feb., '98, p. 18–20) the figure showing a flower with the astonishing number of thirteen whorls of petals; a double flowered

specimen of the same species with about fourteen parts to the perianth was collected by Prof. William R. Dudley in New York State (*The Cayuga Flora*, '86, p. 99); while Britton and Brown (Vol. 1, p. 437) refers to a plant collected in Michigan by Dr. Pitcher which showed the peculiar abnormality of two long-petioled leaves.

The purpose of the following note is to describe a form of monstrosity not as yet recorded for the species as far as the writer knows with the hope that interest in phenomena of this nature may be aroused among botanists of this region.

On May 10, 1916, Dr. F. W. Hitchings brought into the laboratory at Adelbert College three specimens of *T. grandiflorum* which through the kindness of Prof. F. H. Herrick were turned over to the writer for examination. One of these specimens was quite typical, the other two were distinct monstrosities. All three had been gathered in woods in the neighborhood of Cleveland from a large patch of flowers several of which had caught the attention of the collector because of their peculiar appearance. One of the abnormal flowers showed three superposed whorls of sepal-like structures; but since a caterpillar had involved the floral parts in its cocoon, this flower was rejected. The other abnormal flower, however, was a vigorous and uninjured one, consequently its structure was examined in detail. The leaves of this plant were normal in shape, size, and position; and there was nothing unusual in the position of the floral parts, since they were borne on a short peduncle 4 cm. above the leaves. In structure however, the flower differed markedly from the normal. Instead of showing the usual succession of a whorl of three sepals followed by three large white petals, the perianth consisted of three successive whorls of sepal-like structures surmounted by a whorl, the members of which partook of the nature of petals and sepals as shown in Fig. 2.

The first or lowest whorl consisted of three sepal-like structures similar in color, venation, and texture to sepals but more elongate-lanceolate in shape, 5.5-6 cm. long by 1.8-2 cm. wide at the widest part, (Fig. 2 and 3). In the second whorl, which alternated with the first, the members were smaller, being 4.5-5 cm. long and 1.2-1.5 cm. wide, and slightly paler in color, (Fig. 2 and 3.) The members of the third whorl were alternate to those of the second, but with a slight twist to the right so that they were not directly above the first, (Fig. 2 and 3).

The parts were similar to those of the second whorl, but smaller, 3.5–4 cm. long by 1.1–1.5 cm. wide, and paler in color. The fourth whorl was in appearance far more petaloid than the first three, (Fig. 2). In shape the parts were obovate and rounded similar to the normal petals; but the texture was softer, and the size smaller, the dimensions being 4 cm. long and 2.5–3 cm. wide. One member was pale green with a splotch of white on one end, and with a median streak of white; the next was about two-thirds green, with the remainder white; while the third was nearly one-half white.

Not only was the perianth abnormal but the sexual organs of the flower also showed a very unusual structure, (Fig. 3). Only one stamen was present, there being no trace of the other five usually present in Trillium. On comparison with a stamen from a normal flower, the structure was found to be perfectly regular; and a microscopic examination of the pollen showed nothing exceptional in its appearance, (Fig. 5). Furthermore, both in pure water and in water with the addition of a very little cane sugar, the pollen grains from this single stamen germinated readily, indicating that they were potentially functional. In contrast to the trimerous arrangement of the parts of the normal flower and also of the perianth of this flower, the pistil showed 4 divisions, (Fig. 3). The pistil was somewhat smaller than is customary; and consisted of 4 spreading styles with the well known shape and characteristic stigmatic surface, surmounting the 4 lobed ovary containing 4 placentæ. The structure of the ovary can best be shown by a diagram of the cross section, (Fig. 4). It will be noted at once that the fourth lobe is smaller than the other three, and somewhat deeply constricted from them. Ovules were borne in all 4 divisions of the ovary, however, and were perfectly normal as far as could be seen although their functionality was not determined.

Perhaps the most remarkable thing about the flower is the persistence of the single functional stamen. Forms have been found with the number of sepals increased or with a tetramerous arrangement of the essential parts; but the combination of characters seen in this form, and especially the existence of the single stamen renders this flower rather an unusual one even as a monstrosity.

The interpretation of abnormal forms is a matter of considerable interest. At first the writer was inclined to regard the flower as diseased, the abnormal structure representing a response on the part of the plant to the stimulating effect of some fungus or insect injury. In spite of the most careful examination however, no evidence of any infection was found; and the writer was forced to regard the flower as a typical instance of monstrous growth. Such an abnormality can be regarded either as reversion to an ancestral type, or as a morphological translocation, or as a mutation. To those interested in the interpretation of these forms a very able discussion of the matter in a paper by Leavitt (*Rhodora*, Vol. 7, '05, p. 13–19 and 21–31) will undoubtedly prove of interest. The writer is not satisfied himself as to the true explanation of an abnormality such as this; and prefers merely to record the case here as one of interest, leaving the interpretation thereof to those more competent for the task. In connection however, with the possibility that such forms as these are mutations it is of interest to note that the abnormal *T. undulatum* described by Mr. Deane from Squam Lake, N. H., seemed to remain constant for years under natural conditions, while the double flowered *T. grandiflorum* from Ohio reported by Mrs. Kellerman remained constant under cultivation for ten years always producing an excessive number of petals. It is unfortunate that none of the ovules of the plant described by the writer had matured so that they might be planted to determine whether this abnormality also was one to which the offspring would breed true. One can only conjecture what the result would have been had the pollen of this plant been made to fertilize a normal flower; and the writer very much regrets that no growing plants were available so that this most interesting experiment could be attempted. Next season the writer hopes to visit the spot from which this specimen came; and make a further study of the inheritance of this abnormality. In the meantime he would be very glad to receive from botanists of this region data on any unusual forms of this unstable genus.

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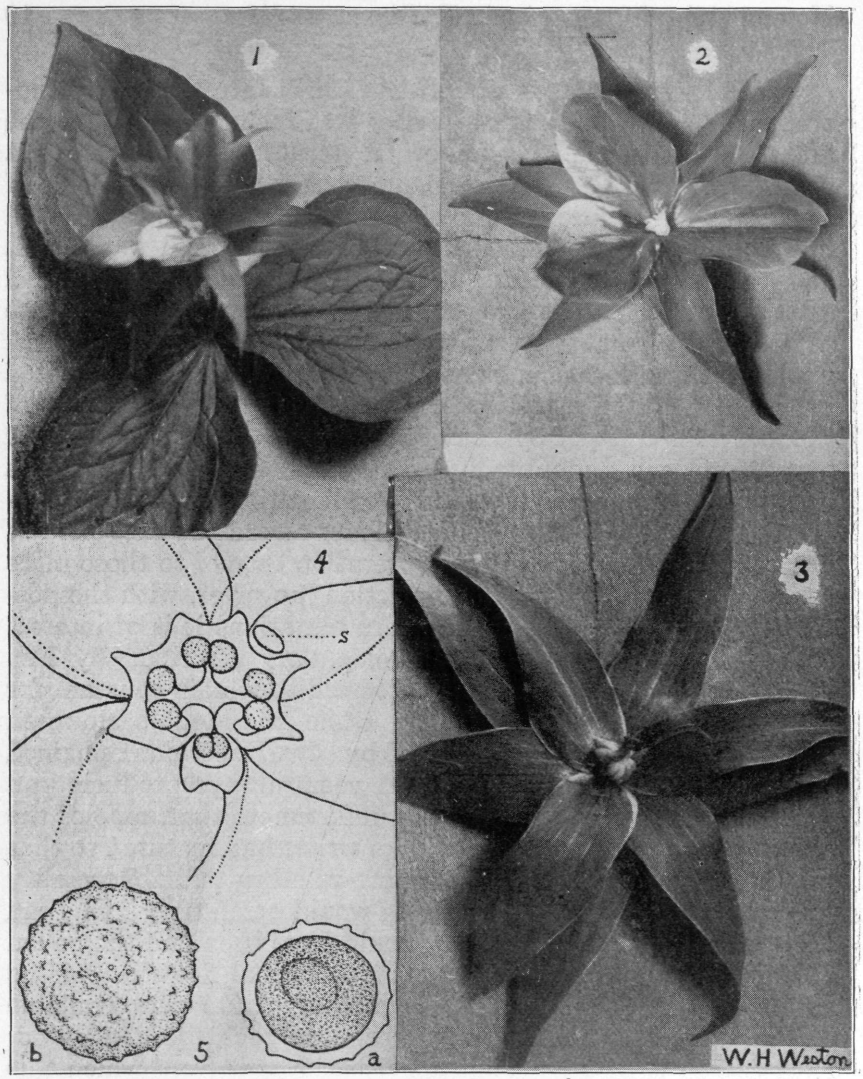

EXPLANATION OF PLATE I.

Figs. 1-3 photographs of living plant. Figs. 4 and 5 drawings made with camera lucida, slightly reduced in reproduction.

FIG. 1. Flower and leaves (one-third natural size) showing position and arrangement of parts.

FIG. 2. Flower seen from above (one-half natural size) showing the parts of the perianth with the pistil in the center; the single stamen at the right.

FIG. 3. Flower with petaloid structures removed (natural size) showing three superposed whorls of sepals, with 4-lobed ovary in the center and single stamen at right.

FIG. 4. Diagram of cross section of ovary (x 4) showing tetramerous structure, placentæ, and ovules. Position of petaloid structures shown by solid lines; position of uppermost whorl of sepals shown by dotted lines; position of stamen indicated at *s*.

FIG. 5. a, Pollen grain, just shed, seen in optical section, x 640. b, Pollen grain about to germinate, surface view, x 640.